

Chapter 6.9 DEQ REGIONAL WATER QUALITY INITIATIVES

SOUTH CENTRAL REGIONAL OFFICE (SCRO)

Total Maximum Daily Load (TMDL) Activities

There are currently four (4) TMDL studies either being conducted or have been completed by SCRO water compliance and assessment staff over the past two years. The projects are listed in detail below.

Dan River Basin – The project will address bacteria impairments in the Dan River as well as several tributaries, including Sandy River, Sandy Creek, Fall Creek, Byrds Branch and Double Creek. The report is scheduled to be finalized by December 2007. A local Steering Committee has been formed. Members include Local, State and Federal Officials, citizens, utility personnel, watershed organization members and educators. A public meeting was held to discuss the TMDL process and the sources of bacteria unique to the Dan River Basin.

Banister River Basin – The final TMDL report was submitted to EPA on August 1, 2007. The project addressed bacteria impairments in the Banister River and several tributaries, including Whitethorn Creek, Cherrystone Creek, Sandy Creek, Stinking River, Bearskin Creek and Polecat Creek. A local steering committee was formed and several meetings were held to discuss technical aspects of the report. Additionally, public meetings were held to discuss draft chapters of the report throughout the development process.

James River and Tributaries (Lynchburg) – The final TMDL report was submitted to EPA on September 7, 2007. The project addressed bacteria impairments in the James River and several tributaries, including Blackwater Creek, Ivy Creek, Judith Creek, Tomahawk Creek, Burton Creek and Fishing Creek. Steering committee and public meetings were coordinated by the Region 2000 Local Government Council staff in an effort to increase stakeholder participation. Several steering committee meetings were held in response to concerns the City of Lynchburg had regarding the TMDL and its relationship to the Combined Sewer System (CSS) it operates. The City also had concerns about the Phase II MS4 Permit and how the TMDL relates to the MS4 permit requirements. Virginia DEQ and Virginia Department of Conservation and Recreation (DCR) staff were invited to address program concerns at the steering committee meetings. All concerns were addressed and the report was finalized.

James River and Tributaries (Buckingham) – The final TMDL report was submitted to EPA on June 28, 2007. The project addressed bacteria impairments in the Slate River and several tributaries in Buckingham County, Virginia. The tributaries include the North River, Austin Creek, Troublesome Creek and Frisby Branch. A local steering committee was formed to review the technical aspects of the report development. The report findings were also presented to the public once the report was drafted.

Roanoke (Staunton) River Basin PCB TMDL Study

The PCB TMDL study will cover the entire Roanoke River Basin and be done in conjunction with the DEQ West Central Regional Office. In 1999 & 2000, source identification work was completed in the Altavista and Brookneal areas. BGF Industries, in Altavista, was identified as a legacy source of PCB contamination. Remediation efforts are underway at the facility while additional source monitoring and identification is completed to support the study. The use of Semi-Permeable Membrane Devices (SPMDs), or “virtual fish”, has provided data to complete the TMDL. Results from PCB sampling were received in the summer of 2007. Several sites showed elevated levels of PCBs and additional sampling was deemed necessary. The additional sampling is currently ongoing.

The results from the initial round of sampling were presented in a unique forum by DEQ staff members. The forum was held in Brookneal, Virginia on August 9, 2007. There were no formal presentations given. However, citizens were able to visit “information booths” manned by DEQ staff, with poster displays and handouts. The general consensus of the forum was the public had their questions answered or knew how to contact appropriate staff if they had additional questions.

The most recent fish tissue and sediment sampling results were also presented at the forum. The results continued to show elevated levels of PCBs, but for the first time, the results showed elevated levels of mercury. DEQ provided information on mercury and the potential health effects along with the PCB information. The Virginia Department of Health issued an additional fish consumption advisory for mercury soon after the results were published.

Citizen Monitoring Support

Students at the Central Virginia Governor's School in Lynchburg have collected bacteria samples on an annual basis, coordinating sampling locations with SCRO. This coordination is beneficial for establishing the greatest monitoring coverage. In 2007, the students will begin to monitor nutrients, benthic macro-invertebrate communities, and total mercury.

Two (2) citizen lake monitoring programs have formed over the past two years. The Leesville Lake Association and the Timberlake Homeowners Association have developed monitoring strategies and received DEQ grant funding to monitor the lakes during critical periods. The Leesville Lake Association collects their data using a multi-probe sampler on loan from DEQ. The data from this monitoring program are reported each month to SCRO. The Timberlake Homeowners Association collects water samples to be sent to the state laboratory for analysis. These data are also sent to SCRO for review every month.

Coordination with US Army Corps of Engineers – John H. Kerr Reservoir & Dam

The Roanoke River, downstream of the John H. Kerr Reservoir and Dam, experiences seasonal dissolved oxygen changes due to the natural stratification of the reservoir. These natural changes often result in violations of the dissolved oxygen criteria especially below the dam. During months when the reservoir is stratified, water from below the thermocline is released through the dam to generate hydroelectric power and discharged to the river downstream.

This segment of the Roanoke River has been listed on the Virginia Impaired Waters list since 1996 and was slated for TMDL development by 2010. SCRO contacted the US Army Corps of Engineers (USACOE), which owns and operates the dam, to determine what changes to their operations could occur to correct the water quality problems.

The USACOE has plans for retrofitting the dam and updating several of the power generating turbines with those fitted with aeration capabilities. The retrofitted turbines should increase the dissolved oxygen levels enough to maintain state standards. SCRO will work with the USACOE to monitor the progress of the retrofit and determine when the segment can be removed from the Impaired Waters list.

Greater Lynchburg Environmental Network

The Greater Lynchburg Environmental Network (GLEN) has become a clearinghouse for environmental issues and concerns in the Greater Lynchburg region. A comment at the final public meeting for the Lynchburg area TMDL development fostered discussion between local stakeholders to enhance GLEN. Several forums and meetings were held to determine pertinent regional environmental issues and ways to address them as an organization. An electronic mailing list has been created to alert members of ongoing events in the region. Monthly meetings and presentations are also ongoing to continue to develop the organization and inform members of how they can become involved with regional environmental issues.

DEQ/Dan River Basin Association Memorandum of Understanding

The SCRO has drafted a Memorandum of Understanding (MOU) in conjunction with the Dan River Basin Association (DRBA) to be signed by both parties in October 2007. The MOU represents a commitment from both organizations to work together on restoring and protecting water quality in the Dan River Basin. This commitment will be displayed through activities such as DEQ's support in developing a DRBA citizen monitoring plan and DRBA's participation in developing basinwide TMDLs.

College Lake/Blackwater Creek Watershed Management Plan

Over the past year, SCRO staff has attended meetings to develop and write a watershed management plan for the Blackwater Creek Watershed within the City of Lynchburg, Campbell and Bedford Counties. The effort has been spearheaded by staff and faculty at Lynchburg College with a particular focus on water quality impacts seen on College Lake. The Lake was built in 1934 and was nearly 45 acres in size. Today the Lake is approximately 18.5 acres in size due to sediment deposition over the years. The Plan will focus on controlling urban non point source pollution and limiting the amount of sediment and nutrients that end up in College Lake. The group has received several state and federal grants to complete the initial analysis of the watershed and write the management plan.

Adopt-a-Stream: Blackwater Creek

The SCRO has adopted a 2.8 mile segment of Blackwater Creek in Lynchburg. The segment is currently impaired for bacteria. A clean-up held in April 2004 yielded 3200 lbs. of trash, including 40 tires. SCRO has agreed to hold clean-ups on this adopted segment once a year.

Biological monitoring in the Lynchburg Area

SCRO Regional Biologists are performing initial benthic macroinvertebrate and habitat assessments of water quality in the City of Lynchburg. Multiple sites within the watershed will be assessed to determine the presence and extent of potential stressors. The City of Lynchburg conducts biomonitoring as part of the Combined Sewer Overflow remediation efforts across the city, which establishes baseline information for several streams in the city. The DEQ study will increase the resolution of sampling within the city by monitoring several sites on the tributaries to Ivy and Blackwater Creeks.

VALLEY REGIONAL OFFICE (VRO)

Shenandoah and James River Fish Kills

DEQ's Valley Regional staff has been investigating fish kills from unknown causes in the Shenandoah River system since 2004. This disturbing trend continued in 2007. Springtime fish kills and skin lesions on fish in the North and South Forks of the Shenandoah River occurred for the 4th straight year in 2007. Perhaps even more disturbing is similar fish kills were detected in the upper James River system this spring, including lower portions of the Cowpasture River, a stream being used as a "clean" reference for the studies on the Shenandoah River. These fish kill events affected mostly smallmouth bass and sunfish and also seemed to have a much greater impact on adults of those species. Key investigations conducted during 2007 are listed below.

Water Quality and River Sediments

- Weekly sampling for ammonia and nutrients at 12 sites (DEQ).
- Episodic storm event sampling at various sites throughout the watershed as measurable runoff events occur (DEQ, DGIF, and several citizen monitoring organizations).
- Sampling at 11 locations with passive water samplers designed to detect compounds not readily measured through conventional water sampling (DEQ)
- Parallel sampling at 2 locations with passive water samplers in the same manner outlined above (Friends of the North Fork, funded by Virginia Environmental Endowment).
- Monthly laboratory chronic toxicity tests of river water at 4 sites (USEPA)
- Continuous recording of pH, temperature, dissolved oxygen, and conductivity with water monitoring instruments at 6-8 sites (DEQ, with assistance from USEPA).
- Sediment toxicity and estrogenicity tests at 9-12 sites (USEPA).
- Sediment analyses for a wide range of contaminants (USGS)
- Contaminant profile of contaminants expected to be found in the Shenandoah Valley and those with the potential to be associated with the conditions and impairments observed in the fish kills (multiple collaborators).

Fish and other Aquatic Life

- Fish - Extensive sampling and collections of fish from the North and South Forks of the Shenandoah, the Shenandoah mainstem, and a reference stream, the Cowpasture River, during a period when no fish kills are occurring. Fish will be evaluated externally and internally within individual organs for histology, pathology, bloodwork, and viruses and bacteria (USGS, Fish Health Lab, Leetown, WV). This same work will be conducted on dead or dying fish during fish kill events that may occur in 2007.
- Fish – Viral, bacterial and other disease evaluations (US Fish & Wildlife Service and several University researchers).
- Fish – whole body burden analyses for a wide range of contaminants, with possible analyses of selected body organs for a portion of fish sampled (DEQ)
- Benthic macroinvertebrate evaluations, combined with water quality data on nutrients and ammonia to determine associations between these variables and locations of fish kills. Study began in 2006 on 9 DEQ water sampling sites and will continue in 2007 (Virginia Tech).
- A companion benthic invertebrate study will occur in 2007 on 25 tributaries to the Shenandoah and will expand water chemical analyses to include compounds expected from agriculture runoff (VA Tech, funded by Virginia Environmental Endowment)
- Fish community-level analyses at multiple sites throughout the Shenandoah drainage (VCU).

A key to the Shenandoah River fish kill evaluation continues to be the collaborative approach DEQ and the Department of Game & Inland Fisheries (DGIF) have employed throughout this investigation. In addition to the regular meetings, discussions and cooperation between the members of the Shenandoah River Fish Kill Task Force, DEQ and DGIF have gained much insight and assistance from EPA's CADDIS impairment analysis process (fall 2006 and winter 2007 workshops) and the Chesapeake Bay Foundation's multi-state Fish Health Workshop (January 2007). Many of the experts and researchers involved in those events have continued to provide support and advice as DEQ and DGIF implement the 2007 work plan. In addition, DEQ and DGIF staff are communicating and coordinating with West Virginia officials, who continue to investigate similar fish kills on the South Branch of the Potomac River.

The cause(s) of these fish kill events remains unknown. Water quality data and preliminary fish pathology and disease data have been inconclusive. Results from the complex studies being conducted on passive samplers, benthic communities, and fish health (including viruses, bacteria, histology, and blood) are pending and should be available during late 2007 or early 2008. These results will be critical in shaping the focus of investigations for fish kills that are anticipated next spring. A DEQ-funded Research Advisory Committee, headed by Drs. Greg Garman of Virginia Commonwealth University and Don Orth of Virginia Tech is developing a research work plan for 2008.

South River Mercury

Mercury was used in a manufacturing process at the DuPont plant in Waynesboro, VA from 1929-1950. Losses and contamination from that process resulted in a legacy problem that continues today. In a 1984 settlement between Dupont and the State Water Control Board, a fund was established to support monitoring of water, sediments, and fish tissue in the river system for a projected 100-year period. In 2006, DEQ established a full time position in the Valley Regional Office to focus on this serious environmental issue. Specific activities in this program area during 2007 are outlined below.

- a) **Collection and Analysis of Fish Tissue for Mercury Content - South River and South Fork Shenandoah River.** The South River and the South Fork of the Shenandoah River have been under fish consumption advisories since the 1970s, when mercury was first discovered in the river. As part of DEQ's ongoing monitoring of fish tissue, samples were collected from a number of sites in spring 2007, with analyses expected to be completed in early 2008. Details of past South River and South Fork Shenandoah River fish tissue contamination can be found at <http://www.deq.virginia.gov/fishtissue/mercury.html>. The most recent data from 2005 fish collections were evaluated by the Virginia Department of Health and were the basis for continuing the existing consumption advisories. Details on these advisories can be found at <http://www.vdh.virginia.gov/epi/publichealthtoxicology/ShenandoahRiver.asp>. DEQ will be collecting fish tissue samples from these rivers again in 2012.

- b) **Water Sample Collection and Analysis for Mercury in the South River and South Fork Shenandoah River, Virginia.** This monitoring project focuses on water column concentrations of dissolved and total mercury in the South River and South Fork Shenandoah River. Monitoring through the 1990s rarely detected measurable amounts of mercury in water, due to analytical constraints. With the development of more sensitive techniques (“clean” metals sampling and analyses), quantifiable levels are now routinely recorded. Since 2001, DEQ staff has collected total and dissolved mercury samples from multiple sites on the South River and South Fork Shenandoah River on a bimonthly frequency.
- c) **Sediment Sampling in the South River and South Fork of the Shenandoah River.** Since discovery of mercury in the South River in the 1970s, surveys of river sediments have been conducted approximately every 10 years. These data are used to evaluate long term trends and spatial distribution of mercury contamination. Results are used to support other investigations of mercury in the system, including fate and transport, methylation processes, and feasibility of remediation. Sediment samples were collected during 2007 at 1-mile intervals in the South River and 5-mile intervals for the full length of the South Fork of the Shenandoah River. Data are expected from this project in early 2008.
- d) **South River Science Team.** DEQ staff members continue to coordinate with members of the South River Science Team on a number of surveys in which data are gathered for water, sediments, floodplain soils, and biota in and along the South River. The South River Science team is comprised of representatives from industry, academic institutions, state and federal agencies, environmental groups and independent researchers. This group meets quarterly to coordinate efforts, collaborate on future work, and communicate results. Ongoing studies address mercury source identification, fate and transport, methylation processes, and ecological processes.

SOUTHWEST REGIONAL OFFICE (SWRO)

Town of Abingdon—WWTP Upgrade & Expansion

In the fall of 2007, construction of the upgraded Wolf Creek Water Reclamation Facility was completed. Wastewater treatment has been ongoing at this site, near the confluence of Wolf and Town Creeks, since the mid 1960s. The most recent project expanded and upgraded the facility from a 2.75 MGD secondary plant to the current 4.95 MGD and includes tertiary treatment. This capacity will accommodate anticipated service area growth over the next 20 years. The plant now has the hydraulic capacity and the treatment technology to easily handle the wastewater that will be generated in the service area over the design life of the facility.

Downstream land uses along Wolf Creek include agriculture and residential development. In addition, South Holston Lake is approximately six miles southeast of the WWTP and Wolf Creek, the receiving stream, flows directly to South Holston Lake. This lake is a raw water source for the City of Bristol, Virginia, and provides recreational opportunities in the form of boating, fishing, and swimming, as well as lakeside residential housing.

Over the years, the WWTP has been troubled with solids washouts and plant upsets that produce adverse impacts to the receiving stream, Wolf Creek. These incidents are primarily due to the inability to adequately manage the influent flow during wet weather periods. Wolf Creek is listed as an impaired water body from the confluence with Town Creek downstream to the South Holston Lake backwaters. The impairments are mainly due to fecal coliform bacteria but there is a benthic impairment as well. Whereas the impairments are primarily due to agricultural practices and to a lesser extent, urban runoff, the Town recognized it was also a contributor and took a proactive approach toward environmental stewardship. In doing so, the Town went beyond what is required by their VPDES Permit and installed Biological Nutrient Removal (BNR), tertiary filtration, and ultraviolet disinfection, as well as state-of-the-art instrumentation and controls.

Tazewell County PSA—Divides Interceptor

Final 2008

In 1997, a Preliminary Engineering Report proposed to extend the “Divides Interceptor” from the western part of Bluefield, Virginia, west along Route 460 to the Tennessee Valley Divide (hence the “Divides”). In all, close to 150,000 feet of interceptor and gravity collection system was proposed. The first phase (Bluefield, Virginia to Camp Joy) was completed in the spring of 2007 and included installation of approximately 15,000 feet of 12-inch interceptor, 6,300 feet of 8-inch pipe, and other related equipment.

The interceptor generally parallels the Bluestone River. The Bluestone is one of two raw water sources for the Town of Bluefield Water Treatment Plant, which is located approximately 2.7 miles downstream of the lower end of this interceptor. The Bluestone River is also an impaired waterbody due to the presence of fecal coliform bacteria and a benthic impairment in the proposed service area. Whereas the impairments are largely due to agricultural activity, there is also urban runoff and failing septic systems contributing to the problems. Bacteria Source Tracking (BST) data obtained when developing the TMDL indicates that on four separate occasions between September 2002 and August 2003 the human component of the fecal count was between 38% and 84%. The Bluestone River is also home to a state endangered mussel known as the Tennessee heelsplitter (*Lasmigona holstonia*).

There have been documented cases of businesses within this project area that have been forced to close because of failing septic systems and the inability to make repairs due to site constraints. Through implementation of this project, the Tazewell County PSA can address inadequate private disposal systems by providing a public wastewater collection system to the impacted area. In addition, there are two car washes in the service area whose effluent discharges to the Bluestone. Connection to the public system will eliminate these smaller discharges. This project is a big step toward solving existing public health and water quality problems in the Bluestone. In addition, it will provide the catalyst to continue with Phase II and Phase III of the overall project.

Big Sandy Watershed Agreement

The Big Sandy and its tributaries, including the Levisa Fork in Buchanan County, have long been considered stressed and threatened in part because of acid runoff from coal mines and from sewer pipes running straight from homes into creeks and streams. Three states share the watershed, with 50% of it being in Kentucky, 25% in West Virginia, 25% in Virginia, and the Big Sandy flowing into the Ohio River. The Big Sandy River Coalition, a watershed group which promotes water quality in the basin, has promoted an agreement among the three states. Their work has resulted in an agreement for the states to work together to address the restoration of the watershed. The agreement was signed by the Secretaries of the water quality agencies in each state on October 25, 2007.

Big Sandy SEP

As part of an enforcement action involving a local coal company, a Supplemental Environmental Project (“SEP”) was proposed. The SEP, as described in the draft consent special order signed by the company, provides financial assistance to a Public Service Authority for construction of small, decentralized sewer systems in an impacted watershed area. The project addresses a cluster area of older, established homes served by “straight pipe” discharges and cesspools. Limited area and topography make installation of septic systems impractical or impossible, and coupled with distances involved, make connection to a larger municipal system unfeasible. The Big Sandy River Basin has one of the largest “straight pipe” problems in Virginia. This SEP is an effort to address both a water quality issue and a public health issue. This project is consistent with the Three State Agreement recently signed by the Virginia Secretary of Natural Resources.

Bluestone River

A cooperative Regional Applied Research Effort (RARE) Study with EPA-Region 3, USGS, West Virginia DEP and DEQ was completed in 2007. The study consisted of SPMD deployments in the mainstem, in caves and in tributaries and resulted in identification of PCB sources that contribute to the fish consumption impairment in the Bluestone. Results were used to develop the TMDL loadings for PCBs in the Virginia portion of the watershed and will be used in the same manner in West Virginia.

Levisa Fork

A locally controversial discharge permit was issued by DMLR to allow Consolidated Coal Company to discharge water pumped from a deep mine with high chloride concentrations. At the same time, DEQ began a comprehensive TMDL study in the Levisa Fork watershed that includes all impairments. Kentucky increased monitoring downstream in their portion of the watershed and has requested Virginia to share its water quality data. Virginia has added data collection parameters at the state line to include total dissolved solids (TDS) and Chlorides to insure that instream standards are met.

Clinch River

Tennessee announced its intention to list the Clinch and Powell Rivers in 2008 as threatened for aquatic life as it enters the state, based on the threat for the loss of endangered mussels. At the same time, Tennessee requested Virginia to do the same. Virginia is currently evaluating the request. However, this request deviates from Virginia's established water quality assessment listing protocols.

Representatives of the Tennessee Wildlife Resources Agency (TWRA) testified in Nashville that coal silt has increased over the past 15 years and the shellfish population is in decline in these waters. The reported source of the problem is related to coal mining and agricultural land uses in the upper watershed. DMLR and TDEC are meeting to discuss this issue. In the interim, DEQ has reactivated biological monitoring at stations nearest the state line to assess the aquatic life use in Virginia.

Powell River

Tennessee announced its intention to list the Powell River in 2008 for aquatic life impairment as it enters that state based on the loss of endangered mussels. The pollutant is unknown with the source considered to be coming from Virginia. At the same time, Tennessee requested that Virginia do the same. As with the Clinch, Virginia is evaluating this request. As previously recognized, this deviates from established water quality assessment listing protocols. DEQ has reactivated biological monitoring at stations nearest the state line to assess the aquatic life use in Virginia.

Representatives of TWRA indicated the source is related to coal mining and the lack of regulation and control of mine discharges in Virginia. DMLR is collaborating with the ACOE in Ely Creek and Puckett's Creek on water quality improvement projects. DMLR and TDEC met on April 18 to discuss the DMLR enforcement program as well as various initiatives taking place at DMLR to protect the Clinch/Powell watersheds.

A TMDL Implementation Plan (IP) is currently in progress in the Straight Creek watershed. The coal companies that operate in the watershed are voluntarily funding this IP development. To ensure fair representation of all stakeholders, DEQ is overseeing this IP work. TMDL development for additional segments of the Powell River drainage has begun.

DMME, as the agency in Virginia that issues VPDES permits for coal mining facilities, is limiting mining operations based on the waste load allocations in impaired waters where TMDLs are completed. As DMME also administers the abandoned mine lands (AML) program in Virginia, they are promoting a "trading" program for mine owners that wish to reclaim AML sites to offset their own mining operation. DMME is a leader in the nation in this effort to reduce the total pollutant loading to the watershed by trading. In addition, the ACOE has completed two acid mine drainage projects in the Powell River watershed that has removed a large load of pollutants to that watershed.

South Holston Reservoir

The state of Tennessee lowered fish tissue criteria for mercury in Tennessee to the EPA recommended level of 0.3 ppm. As a result, on April 26, 2007 Tennessee added largemouth bass from South Holston Reservoir to the fish consumption advisory list. Children, pregnant women and nursing mothers should avoid eating these fish and others should limit consumption to no more than two meals a month.

Virginia last sampled fish from South Holston Reservoir in 1997 and all results indicated that fish were below the current Tennessee level of concern. None of the fish samples collected in 2002 in the free flowing area of South Holston River exceeded the level of concern. In 2007, Virginia sampled fish from South Holston Reservoir and its tributaries and the results are still pending.

PIEDMONT REGIONAL OFFICE (PRO)

Dragon Swamp Mercury Source Assessment

Portions of Dragon Run/Dragon Swamp and the Piankatank River were initially placed under a Virginia Department of Health (VDH) fish consumption advisory in 2003 due to excessive mercury in largemouth bass discovered during year 2000 fish tissue monitoring by the DEQ. In July 2005, the advisory was expanded to cover the entire length of Dragon Run/Dragon Swamp after further monitoring by the DEQ.

The fish consumption advisory recommends adults eat no more than two meals/month of largemouth bass and that high risk individuals, such as women who are pregnant or may become pregnant, nursing mothers, and young children, are advised not to eat any fish from the respective advisory areas. High levels of mercury in the bloodstream of unborn babies and young children may harm the developing nervous system.

To determine the source of the mercury, the Piedmont Regional Office of the DEQ performed a source assessment study in 2004 through 2006. The study included monitoring mercury levels in water and bottom sediments from 13 locations throughout the Dragon Swamp watershed. It is suspected that the mercury contamination is entering this system primarily from atmospheric deposition. The objective of this study was to examine patterns of mercury distribution within this watershed. The study hypothesis was that if atmospheric deposition is the source of mercury, levels of total mercury will be evenly distributed throughout the watershed. If local "hotspots" or areas of comparatively elevated levels of total mercury were found, this may be an indication of local "ground-based" sources of mercury entering the watershed.

The results of the first year of this study indicated no evidence that a local ground source of mercury contributes to the observed contamination in this system. In the second year of the study, all 13 locations were monitored on the same day to determine if any statistically valid differences in water mercury concentrations exist between the stations. All locations were sampled five times in 2006 and, based on an ANOVA analysis, no stations were found to be more contaminated than the rest of the watershed.

The results of this monitoring showed no locations with substantially higher mercury levels than the rest of the watershed (i.e. no obvious "hotspots" were found). Most samples were below the laboratory detection level of 1.5 parts per trillion (ppt). The highest value measured (10.6 ppt) was well below the EPA Human Health standard for public drinking water supplies (50 ppt) and > 70 times less than the Chronic Aquatic Life standard of 770 ppt.

These results help substantiate the conclusions of this study that there is no evidence of a local ground based source of mercury contamination in this system.

305(b) Initiative – Atmospheric Deposition of Mercury at Harcum, VA 2004-2007

In response to concerns relating to the 2003 VDH fish consumption advisory for mercury (Hg) in the Dragon Run/Dragon Swamp/Piankatank River watershed, the DEQ Piedmont Regional Office entered into a collaborative effort with Dr. William Reay of the Virginia Institute of Marine Science (VIMS) and the DEQ Coastal Zone Management Program to establish and maintain a National Atmospheric Mercury Deposition Network (MDN) station to monitor weekly inputs and loadings of airborne Hg into the watershed. The station was constructed on Dr. Reay's property in Harcum, VA and he maintained it and performed the weekly monitoring tasks. This summary covers the period from December 2004 through June 2007. This project is the continuation of NOAA Grant #NA05NOS4191180.

Dr. Reay collected ninety-four (94) weekly samples of rainfall for analysis of Hg deposition concentration at the Harcum station during this study. There were 25 other weeks in the period where there

was no precipitation to sample. An MDN laboratory in Illinois analyzed the samples for total Hg. The mean Hg concentration for the period was 9.1 ng/l (SD=6.85 ng/l) and the mean deposition load, which combines rainfall with Hg concentration, was 185 ng/m² (SD=214 ng/m²). The concentrations and loads varied widely from a minimum concentration of 0.92 ng/l and load of 3.91 ng/m² to a maximum concentration of 40.4 ng/l and load of 1697 ng/m². There appeared to be a pattern of seasonality in the Harcum data; monthly totals generally showed highest deposition loads in the summer and lowest loads in the winter. This pattern also appeared in the other two station datasets from Virginia, which are located in Culpeper, VA and in Shenandoah National Park. Harcum data was also compared with data from stations in Acadia National Park in Maine and Everglades National Park in Florida. The lowest Hg concentrations and loads generally appeared in the upper Northeastern USA as evidenced by mean Hg at Acadia, ME of 6.8 ng/l. Mid-Atlantic concentrations and loads were mid-range as shown by Harcum at 9.1 ng/l. The far Southeastern USA had the highest concentrations and loads, reflected by the Everglades mean Hg of 14.1 ng/l.

The Harcum, VA station VA98, Hg dataset may be found at <http://nadp.sws.uiuc.edu/sites/siteinfo.asp?id=VA98&net=MDN>. The summary report may be obtained from Mark Alling of Virginia DEQ by emailing msalling@deq.virginia.gov.

Tyson Foods, Inc. Glen Allen Ammonia Study

Data analysis in summer 2005 showed elevated ammonia levels in an unnamed tributary of the Chickahominy River below the Tyson Foods permitted discharge. The ammonia levels exceeded the allowable chronic 30-day average water quality standard, however, the data was limited to instantaneous grabs, so direct comparison to the chronic standard was not possible.

DEQ performed a study in July-August 2005 to determine if ammonia levels exceeded chronic water quality standards in the stream. Samples were taken at 7 locations on the tributary, including upstream and downstream of the discharge, in a downstream pond, and below the dam. Samples were taken daily Monday-Thursday to allow better comparison to the 30-day average standard. During this month-long study, acute and chronic ammonia violations, pH violations, and maximum temperature violations were noted at various locations. In addition, two separate fish kills were documented during the study; one of the fish kills coincided with an unanticipated wastewater treatment plant bypass that caused exceedences of permit limits for total phosphorus and total suspended solids in the effluent.

Based on the results of the ammonia study, Tyson Foods has initiated an upgrade to their wastewater treatment plant.

James River Park Bacteria Study

The 2002 303(d) list of impaired waters included the James River through Richmond as impaired of the Recreation Use because of exceedences of the monthly geometric mean for fecal coliform. There is a dearth of real-time fecal coliform bacteria data available for the public to use in making decisions regarding the recreational use of the James River within James River Park in Richmond. Therefore beginning in August 2002, the Department of Environmental Quality and James River Park joined forces to expand the water quality monitoring conducted in the James River during the summer months.

Staff and volunteers from the park collected water samples to be tested for fecal coliform bacteria on a regular schedule from five locations on the river where there is heavy recreational use. The sites are listed below:

- Ponypasture
- 42nd Street in the river
- Texas Avenue Beach
- Belle Isle just above Hollywood Rapid
- Tredegar Iron Works

The water was sent to state laboratories for analysis funded by DEQ, and results are posted on the DEQ web site. The study was continued through 2005. During 2006, monitoring at these stations was

Final 2008

conducted once per month by DEQ as part of the James River TMDL study and once per month two weeks after DEQ by James River park staff.

Defense Supply Center (DSCR) Study

The Defense Supply Center of Richmond (DSCR) is a large federal material storage and distribution facility that is subject to numerous state and federal environmental laws and regulations. In addition, this facility has an active Superfund project to contain and clean up contamination from past operations on the site. The Virginia Department of Environmental Quality (DEQ) interacts with this facility on a regular basis to ensure they comply with all applicable environmental rules.

Upon learning of public concerns about TCE (trichloroethylene) contamination in water leaving the site, DEQ staff performed a special study in 2002 to determine whether there was unusual contamination in the small stream (referred to as No Name Creek) that receives stormwater runoff from the Defense Supply Center of Richmond (DSCR). The study involved taking water samples from the stream during and immediately following rainfall events, and testing for bacterial contamination, TCE and other contaminants. Analysis of the samples indicated low levels of TCE and some other contaminants. However, the concentrations were well below any established human health risk levels. Special tests were performed to determine if bacteria found in the samples came mostly from animal or human sources. Human bacteria contamination from failing septic tanks was noted in the stream. Chesterfield County subsequently decided to expand their sewerage service area to include Rayon Park, a residential community adjacent to DSCR and No Name Creek.

In addition to the water chemistry analysis, a good indicator of pollution in a stream is the amount and diversity of aquatic life that exists there. A biological stream assessment was conducted in No Name Creek by a DEQ aquatic biologist. The findings indicated that the stream had aquatic organisms that were typical for a small stream in an urban area. There was no indication of unusual biological impacts.

Harmful Algal Bloom Response and Monitoring Program

The DEQ maintains fixed monitoring stations and investigates fish kills to determine whether they are caused by algal blooms, and, if so, to determine whether toxic *Pfiesteria*-like organisms (PLO) are present. Many fish kills are juvenile menhaden kills which are typically attributed to low dissolved oxygen and stranding overnight at low tide. In most instances no lesions are observed on these fish, PLO counts are low, and DNA probe results are negative. However, fish kills are often caused by both toxic and non-toxic algal blooms. In the early stages, the blooms elevate dissolved oxygen (DO) and pH, and as the bloom dies, DO can drop to hypoxic levels resulting in fish and crab kills. In addition, PLO and other toxic algae can cause lesions on fish and have been attributed to health effects in fisherman.

At the monitoring sites, DEQ collects dissolved oxygen, pH, temperature, and a full range of water quality analyses - including dissolved, particulate and total phosphorus and nitrogen, urea, chlorophyll a, biochemical oxygen demand, total suspended solids, and total organic carbon. Algae samples are collected by the DEQ and are sent to Old Dominion University for identification and *Pfiesteria*-Like Organism (PLO) algal cell counts, and are sent to the Virginia Institute of Marine Science (VIMS) for DNA probe identification.

Specific Investigations:

In 2004, PRO monitoring staff investigated a prolonged *Microcystis auruginosa* bloom in the Potomac River at Colonial Beach from June 25 to July 4. On the evening of June 24, a bright blue-green paint-like material was noted in the Potomac off the Colonial Beach riverfront. The material came onshore with the flood tide and reports indicated that some children had developed rashes on their backs. PRO staff began investigating on June 25th and Colonial Beach officials closed the beach to swimming. By June 28, there were 1.8 million cells/ml *Microcystis* in the Potomac River less than 10 meters from the Colonial Beach shoreline off the end of Colonial Avenue and analysis indicated 3 ppb Microtoxin in the beach area. Colonial Beach had re-opened the beach to swimming on Sunday July 27th, but closed it again on June 28.

By June 30th, the sample at the end of Colonial Avenue had 4000 cells/ml, with a Microtoxin value <

0.5 ppb. However, there was a pocket of heavy HAB further down the beach. The cell count there was 1.9 million cells/ml with 1100 mg/m³ chlorophyll a, with a Microtoxin concentration of 3 ppb. There was a concern that with the tidal movement, the most dense bloom area could move anywhere along the beach.

PRO staff continued to monitor the bloom throughout the holiday weekend, due to the tourism that was expected at the beach. On Saturday and Sunday (July 3 and 4), analysis indicated < 500 cells/ml with Microtoxin values below the detection limit of 0.5 ppb at several locations along Colonial Beach. The bloom appeared to be over and Colonial Beach removed the posting signs on July 4.

In 2005, PRO staff investigated nine incidents, including two juvenile menhaden kills, a filamentous blue-green algae bloom near Hopewell, and several dinoflagellate red tide blooms. On September 29th – October 9th, PRO monitored a blue-green *Anabaena* bloom in the James River near Scottsville, which is approximately 65 miles upstream from the City of Richmond. There was concern about possible taste and odor problems in Richmond's drinking water supply if the bloom reached the intake. However, tropical storm Tammy flushed the bloom past the city of October 9th. No fish kill was reported.

On April 1, 2006, PRO responded to a report of skin rashes and lesions from water exposure in the Potomac River near Colonial Beach. Old Dominion University identified low levels of diatoms and no toxic dinoflagellates. The rashes and lesions were reported to the Virginia Department of Health. A possible red tide bloom was noted 10 miles upstream.

Coastal 2000 Initiative - Water Quality, Biomonitoring and Sediment Toxicity of Virginia Estuaries

PRO and TRO have sampled randomly selected probabilistic estuarine stations on the western and eastern Chesapeake Bay shores as well as the ocean side of the Eastern shore from summer 2001 to 2007. Probabilistic studies answer questions such as "What percentage of Virginia estuaries have low dissolved oxygen?" Sampling crews obtain filtered chlorophyll a and nutrients, particulate nutrients, total suspended solids, benthic infauna, sediment metals, organics, particle size, and toxicity samples, light attenuation data, and depth profiles for DO, temperature, pH, conductivity and salinity. Each station is sampled once. Field duplicate samples are collected at one station per run, to cover 10 percent of samples for each parameter. Hydrolabs are pre- and post-calibrated and maintained according to agency SOPs. The results of the study are incorporated into the 305(b) assessment.

Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams

In 2001, DEQ initiated the Probabilistic Monitoring (ProbMon) study. The aim of ProbMon is to provide accurate statewide and regional assessments of the conditions of Virginia's freshwater streams. A total of 50 streams ranging in size from first order to sixth order are sampled statewide annually. Of these, PRO has annually sampled approximately 15 randomly selected probabilistic non-tidal stream stations in the Piedmont and Coastal Plain ecoregions. The Regional Biologist gathered representative samples of benthic macroinvertebrates, performed comprehensive habitat assessments, and obtained DO, temperature, pH, and conductivity data. Each station was sampled twice, once in the spring and again in the fall. Fall sampling includes water quality samples for nutrients, solids, chlorophyll a and fecal coliform bacteria. Hydrolabs are pre- and post-calibrated and maintained according to agency SOPs. Using this 2001-2004 data, a Virginia Stream condition Index has been developed and validated and the results of the initial five-year study have been summarized and are available for review at www.deq.virginia.gov/probmon/. The program is expected to continue and it is estimated that over 600 locations will be sampled by 2010.

TIDEWATER REGIONAL OFFICE (TRO)

The Elizabeth River Program

In 1997, in response to indications of toxic impairment of water quality in the Elizabeth River and its tributaries, DEQ and a group of Elizabeth River Project stakeholders collaborated to produce a comprehensive WQM plan for the water bodies of concern. Under guidelines included in that plan, a baseline environmental study began in January 1998, with the goal of allowing the future assessment of trends in contaminant concentrations and their effects. Scientists from the Virginia Institute of Marine Science, Old Final 2008

Dominion University, and the Department of Environmental Quality are working with representatives from state, federal, and local authorities and other stakeholders to design and conduct this monitoring effort. Several activities that have been continued under this initiative are described below.

Conventional Pollutants / Nutrients

DEQ and ODU continue to monitor for these parameters, which include dissolved oxygen, nitrogen, phosphorus, pH, salinity and temperature. This monitoring, while done previously at a limited number of stations, was expanded to 14 stations in 1998 and now includes depth profiles and significantly more detailed nutrient analysis. Although the stream conditions regarding nutrients and dissolved oxygen are still degraded, monitoring trends show significant improvements at many locations in the river. Data can be viewed and downloaded from the Chesapeake Bay Information System [CIMS](#).

TBT Monitoring

Dr. Mike Unger, from the Virginia Institute of Marine Science, has collected Tributyltin (TBT) data at 18 Stations in the Elizabeth River, Hampton Roads and the lower James River six times a year since August 1999. Only rarely have non-detectable (less than 1 part per trillion) levels of TBT shown up in these data. The highest measured concentrations occurred on September 20, 2001 with several stations near the confluence of the Eastern and Southern Branches of the Elizabeth River exceeding 20 ng/L; the highest measured concentration was greater than 70 ng/L at a station in the Southern Branch. However, no exceedences of the acute standard (360 ppt) have been observed. A summary of the monitoring results can be viewed at http://www.vims.edu/env/projects/tbt_deq/. A report summarizing the Tributyltin monitoring program can be found at http://www.vims.edu/env/projects/tbt_deq/DEQ%202007%20TBT%20Report.pdf.

Benthic Index of Biotic Integrity (BIBI) monitoring

Dr. Dan Dauer (Old Dominion University) initiated a study of the macrobenthic communities of the Elizabeth River watershed in summer 1999 as a means of characterizing the health of the benthic communities of the Elizabeth River watershed. A probability-based sampling design allows calculation of confidence intervals for estimates of condition of the benthic communities and allows estimates of the geographic extent of degradation of the benthic communities. Results for 1999 to 2006 are summarized in the table below.

Monitoring Year	Percent bottom substrate not meeting restoration goals	B-IBI values
1999	64 ± 10.1	2.7
2000	72 ± 17.6	2.6
2001	52 ± 19.6	2.7
2002	72 ± 17.6	2.4
2003	80 ± 15.7	2.3
2004	88 ± 12.7%	2.2
2005	84 ± 12.7%	2.2
2006	80 ± 15.7%	2.4

In general for the Elizabeth River watershed, species diversity and biomass were below reference condition levels, while abundance was above reference condition levels. Community composition was unbalanced, with levels of pollution-indicative species above, and levels of pollution sensitive species below reference conditions.

Copies of relevant Elizabeth River Monitoring Reports by Dr. Dauer are available at: <http://sci.odu.edu/chesapeakebay/reports/elizabeth.shtml>.

Harmful Algal Blooms/Pfiesteria Monitoring

The Department of Environmental Quality and the Department of Health, including the Division of Shellfish Sanitation, work together to respond to potentially harmful algal blooms (HABs, including Pfiesteria).

Final 2008

Samples from algal blooms and fish kill sites are sent to Old Dominion University and the Virginia Institute of Marine Science for a detailed evaluation for potential harmful algae species. Additional information can be found at: <http://www.vdh.virginia.gov/Epidemiology/DEE/Waterborne/HABS/>.

Coastal 2000 Initiative

The Tidewater Regional Office has been involved with the Coastal 2000 Program. Data has been collected from 2001 through 2007. For additional information contact the project manager, Don Smith at (804) 698-4429.

WEST CENTRAL REGIONAL OFFICE (WCRO)

Virginia Roanoke River Basin Advisory Committee (VRRBAC) and the Roanoke River Basin B-state Commission

WCRO personnel have served as administrative staff for the Virginia Roanoke River Basin Advisory Committee (VRRBAC) since December 2002. DEQ and other State Agency staff have made numerous presentations to VRRBAC to inform members about the issues in the Basin.

VRRBAC was established in the executive branch of state government as an advisory committee to the Virginia delegation to the Roanoke River Basin Bi-State Commission. The Roanoke River Basin Bi-State Commission was established and composed of members from the Commonwealth of Virginia and the State of North Carolina. The purpose of the Commission is to safeguard the Roanoke River Basin's natural resources for the citizens of the Roanoke River Basin. This duty includes providing guidance, making recommendations, identifying problems, disseminating information, and promoting communication, coordination, and education among stakeholders. NC has passed similar legislation. The advisory committees of both States assist the Roanoke River Basin Bi-State Commission fulfill these responsibilities.

A primary goal of VRRBAC is to open channels of communication. The Committee meets throughout the Roanoke basin in an effort to be available to all basin constituents. It is important that dialogue take place which is representative of all areas of the basin. There must be rural and urban cooperation on water issues. Speakers representing various groups, State Agencies, Local Governments, different geographic areas, and interests have addressed VRRBAC. Localities and State entities have provided meeting facilities for the meetings. Such participation demonstrates that VRRBAC has strong partnerships in the region, which helps in carrying out the work of the Committee. Broad public support of policy and regional consensus is the best way to bring about positive change associated with environmental and related health issues. Better efficiency of protection efforts will result as all partners, public, private, federal, state, and local officials, can share and leverage resources. Such coordination and consensus building in the entire basin on watershed management issues is essential to sound watershed decision making and management. Sub-committees have been given direction to promote such an effort using broad-based input consolidated from as many interested parties as possible.

The sub-committees formed are Agriculture and Forestry, Lake Interests, Municipal Interests and Permit Holders, River Interests, and Water. The sub-committees are to prepare position papers on important issues and return them back to the full Committee for discussion and adoption. An effort is being made to bring the most knowledgeable people possible to the table, where the work must take place. The objective is to obtain membership that will represent stakeholders throughout the basin and maintain a geographical and urban/rural balance.

Since the inaugural meeting of VRRBAC, certain characteristics and issues of the basin have become evident. The importance of natural resources to the economic vitality of the Basin is apparent. People reside in and come to the Roanoke River Basin area to pursue various interests including vacation, lifestyle, esthetics, boating, fishing, etc. These activities and personal values help drive the economic engine of the local and regional area. In addition, agriculture is vital to the region's lifestyle and economy. Clean water and ample flow and supply are recognized as essential to existing beneficial uses and future economic growth.

There are interrelationships within the basin involving flow, as events in one section of the basin can impact other parts. Environmental, ecosystem, human health, power generation, aquatic life, and economic needs of the basin must be balanced. The generally good water quality of the Roanoke basin is valued and must be preserved. Issues and topics which are crucial to the well-being of the basins population include: 1.) Inter-basin transfer of water, 2.) Water withdrawal, 3.) Regulation of flow and storage, 4.) Invasive species, 5.) Recreation and fishing, 6.) Water quality and, 7.) Lake vitality.

In 2007, VRRBAC focused on a couple of issues that will benefit the Basin in Virginia. A letter was sent to localities encouraging them to inventory their existing Brownfield sites. VRRBAC worked with the Planning District Commissions (PDCs) to target attendees to a Brownfields Forum. Also, VRRBAC met with key regional environmental educators to learn about these efforts. VRRBAC sees education as a key to protecting and enhancing the Basin's natural and other resources and wants to help facilitate these efforts.

VRRBAC has adopted several positions regarding the Basin's natural resources. It supports the TMDL process and the implementation of BMPs and other strategies such as Low Impact Development (LID) and Nutrient Management Plans to correct pollution problems. VRRBAC favored the development of a Virginia State-wide Water Policy, but only one that mandated local stakeholder input and is against the inter-basin transfer of water that is detrimental to the people of the basin. VRRBAC is opposed to any new water withdrawal until such time that the real and potential needs for the foreseeable future are determined. These water quantity issues are highlighted during drought periods. VRRBAC supports a balanced flow regime for the rivers and lakes of the Basin and recommends that all governmental agencies, stakeholders, and private industry work together to balance all interests. It has supported funding for helping localities and regional planning districts meet the requirements of the State Water Supply Planning Regulation, controlling hydrilla in basin lakes, wastewater treatment plant improvements, and conservation easements.

For additional information, see the VRRBAC website at: <http://www.deq.virginia.gov/vrrbac/>.

TMDL Activities in the West Central Regional Office

WCRO's TMDL staff assisted in the completion of Implementation Plans on the Lower Blackwater River watershed, Big Otter watershed, Back Creek, Mill Creek and Dodd Creek. DCR was the lead agency on all of the aforementioned TMDL Implementation Plans except for Back Creek. New River Highlands Resource Conservation and Development Council partnered with Maptech, Inc. to complete the Back Creek Implementation Plan.

WCRO TMDL staff participates in the Stroubles Creek Watershed Initiative (SCWI), which spun off from the Implementation Plan Steering Committee. The SCWI continues to meet as needed to review grant proposals related to the Implementation Plan and participate in various outreach events like Blacksburg's Steppin' Out street festival and Sustainability Week. During Sustainability Week, WCRO set up a "bug tub" featuring local benthic macroinvertebrates and displays with information about water quality. Participants include local residents, Town of Blacksburg, DEQ, DCR, Virginia Tech and leaders in local environmental education initiatives.

WCRO TMDL staff and the DEQ Water Quality Data Liaison coordinated the establishment of Coliscan Easygel monitoring networks in the Big Otter and Looney Creek watersheds. Coliscan sampling and analysis are accomplished in cooperation with the Peaks of Otter Soil and Water Conservation District in the Big Otter watershed and the Mountain Castles Soil and Water Conservation District in the Looney Creek watershed. Collectively, the groups monitor approximately 20 stations.

In 2006, the Montgomery County Public Schools received a Learn and Serve Watershed Grant. DEQ partnered with the school system and participated in two teacher's workshops and a University-Community Partnership Conference. At the workshops, WCRO staff presented information about local water quality monitoring efforts, equipment and TMDLs, while offering support to teachers in the form of technical assistance and equipment. This partnership will continue as new teachers are brought into the program.

WCRO Community Involvement

The WCRO Water Monitoring Group (monitoring, TMDL, and assessment staff) participated in numerous outreach events during 2006-2007. Staff taught area students and teachers about biological monitoring at events such as the Clean Valley Council's Earth Summit, Stream School, and Fall Waterways Cleanup. The group had displays at the Blacksburg Watershed Open House, Blacksburg's Downtown "Steppin Out" Festival, and a Catawba LandCare Organizational meeting informing citizens about TMDLs, water monitoring, and assessments. Staff also made presentations on water pollution, monitoring, and restoration to the Franklin County Master Gardeners organization and participated in two teacher's workshops for Montgomery County science teachers.

LandCare

WCRO staff attended a meeting in the Catawba Valley near Blacksburg Sunday July 22, 2007, sponsored by Catawba LandCare. This group started February 2007, when a small group of neighbors from the Catawba and North Fork Valleys came together to hear about LandCare; what it is, and the concepts behind it. These neighbors came away from that meeting convinced that LandCare should indeed be introduced along the length and breadth of the Catawba Creek and North Fork watersheds including their tributaries. By adopting the LandCare concept, it would enable all stakeholders to take part in the effort to preserve the landscape of Catawba Creek and North Fork Valleys, while at the same time, strengthening its' communities. As a result of that meeting, Catawba LandCare emerged, with the mission of providing education and outreach to the community, encouraging a healthy and sustainable environment in the Catawba Creek and North Fork watersheds, and promoting open space across the Roanoke and Montgomery County boundaries. WCRO TMDL staff set up a DEQ and TMDL display and spoke briefly about DEQ and the TMDL activities in the watersheds. WCRO staff also attended the three day National LandCare Workshop in Blacksburg.

Green Infrastructure

Green Infrastructure is an "interconnected network of land and water that contributes to the health, economic well being and quality of life for communities and people." It is designed to bring together diverse organizations and agencies involved in resource protection, economic development, infrastructure, heritage, recreation, and land management. The initiative is growing in the New River Valley and WCRO staff are active as part of the Advisory Committee.

Girl Scouts

WCRO Water Permitting, Waste and TMDL staff partnered with the Western Virginia Water Authority and worked with local Girl Scout troops to educate them about environmental issues. The girls learned about aquatic insects, water quality monitoring, watersheds and landfills. They collected water quality data including pH, dissolved oxygen, and turbidity from Carvins Cove Reservoir. Troops also toured the water treatment plant in Roanoke. The WVWA and DEQ have partnered to put together this event for two years in a row and hope to make the workshop an annual event.

PCB Source Investigations in the New River VDH Fish Consumption Advisory Area (2002 – 2004)

From 2002 – 2004, an intense search for PCB sources was conducted in the New River watershed from Claytor Lake Dam to the Virginia-West Virginia State line near Glen Lyn. The investigation involved extensive review of VA DEQ agency records, interviews of local officials, citizens, industry representatives, and information provided by the New River PCB Source Study Citizen's Committee. Based on these interviews and follow-up onsite inspections, DEQ teams sampled soil and sediment from multiple areas in the New River Valley in the fall of 2003. The investigation incorporated approximately 50 sites of sediment and soil samples.

NORTHERN REGIONAL OFFICE (NRO)

Biological Monitoring

Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams

Final 2008

NRO has participated in the DEQ's Probabilistic Monitoring Program since its inception in the spring of 2000. This program consists of three sampling components: a thorough examination of the benthic macroinvertebrate community utilizing the EPA's Rapid Bioassessment Protocols, sampling a full suite of chemical parameters in water and sediment, and a physical habitat evaluation at each station. The stations are biologically sampled twice a year. Chemical sampling is performed each spring and fall in conjunction with biological monitoring. The physical habitat evaluation is conducted each fall when the biological monitoring is performed. In 2005, NRO sampled eight probabilistic stations in the spring and fall for a total of 16 sampling events. Nine stations were sampled in calendar year 2006, again each station being sampled once in the spring and fall, for a total of 18 sampling events. The 2007 Probabilistic Monitoring Program concluded with a total of six stations sampled once in the spring and fall for a total of 12 sampling events. Since 2004, as part of the probabilistic program, DEQ has participated in a grant study with the National Academy of Sciences to collect data on periphyton/algae in freshwater systems. Samples for that study are collected at every probabilistic monitoring station each fall.

Follow-up to Citizen Biological Monitoring

Citizen monitoring stations, where water quality degradation was indicated from the 2006 Integrated Assessment, were prioritized for follow-up monitoring. Based on review of the data, eleven biological monitoring stations were established in NRO for 2007. Each location was sampled twice, once in the spring and once in the fall. These data, in conjunction with the citizen data, will be used to assess the stream segments initially identified by non-agency sampling.

Total Maximum Daily Load (TMDL) Activities

Special Study Monitoring in Support of TMDL Development

NRO established 40 special study water quality monitoring stations on selected streams identified in previous 303(d) reports for a bacteria parameter. The special studies were designed to provide monitoring data used to better define the impaired stream segments and to support TMDL development. Between July 2005 and June 2006, 30 stations were sampled monthly, with 14 stations being used for the extensive Bacterial Source Tracking (BST) test method. Between January 2006 and December 2006, nine stations were sampled monthly, with five stations being utilized for the BST test method. Between January 2007 and December 2007, one station was sampled monthly using the BST test method. Additionally, special study biological monitoring was conducted along Accotink Creek and Difficult Run in support of TMDL development, required due to a benthic macroinvertebrate impairment along a portion of each of these streams.

Continuous Monitoring in the Tidal Potomac

NRO initiated a long-term water quality monitoring project in the Occoquan River tidal embayment in the spring of 2005. A portion of the Occoquan River embayment is currently identified in the 303(d) impaired waters list as not supporting the aquatic life use due to exceedences of the water quality criterion range for pH. To better characterize the water quality in the Occoquan River tidal embayment, water quality measurements were made using fixed continuous monitors and grab samples. The water quality monitoring for this study was conducted from April to October 2005. The primary objective of this study was to collect monitoring data throughout the warm season to better characterize the water quality and provide detailed monitoring data to support the development of a pH TMDL. A secondary objective of this study was to provide continuous monitoring data to enable a more accurate assessment of the Chesapeake Bay water quality criteria for dissolved oxygen, water clarity, and chlorophyll.

NRO continued the long-term water quality monitoring project in 2006 on Neabsco Creek. A portion of the Neabsco Creek tidal embayment was identified in the 2006 303(d) impaired waters list as not supporting the aquatic life use due to exceedences of the water quality criterion range for pH. The water quality monitoring for this study was conducted from May to October 2006. Based on the data collected through this long-term monitoring effort on Neabsco Creek, the pH impairment was submitted for delisting via an independent submittal report, which utilized both grab and continuous monitoring data results.

In 2007, NRO reestablished continuous monitoring probe deployment in the Occoquan River tidal embayment and also initiated monitoring in the tidal embayment of Pohick Creek. The monitoring period for these areas was conducted from April to October 2007. Data for all of the long-term water quality monitoring deployments were collected using YSI Model 6600 EDS multi-meters. These instruments were configured to measure and store water temperature, pH, dissolved oxygen, turbidity, and chlorophyll measurements in fifteen-minute increments. In addition to the continuous monitoring with the YSI sondes, water column grab sampling, light attenuation, and Secchi depth measurements were performed at each of the stations where the continuous monitors were deployed.

Special Study Monitoring in Support of the Tidal Potomac River PCB TMDL

Portions of the tidal Potomac River, from the mouth to the head of tide, have been identified by Maryland, Virginia, and Washington, DC as impaired due to elevated levels of polychlorinated biphenyls (PCBs) in fish tissue samples. A multi-jurisdictional project was initiated in 2003 to address the elevated PCB levels in the tidal Potomac River. The project was coordinated by the Interstate Commission on the Potomac River Basin (ICPRB) and included participation from Washington, DC, Maryland, Virginia, and U.S. EPA. A PCB TMDL was developed for the Potomac River estuary, including Virginia embayments, and submitted to EPA for approval in October 2007.

To support development of the TMDL, DEQ performed several types of water quality monitoring in an effort to gather additional information on PCBs in the Potomac River estuary: deployment of semi-permeable membrane devices (SPMDs) in 26 locations, including both free-flowing streams and tidal portions of Virginia's waters, sediment sampling at 16 sites, and water column grab sampling collected at 11 locations. In addition to the ambient PCB monitoring, 11 point source discharges in the tidal Potomac River drainage were sampled. All samples were analyzed using an ultra low detection level for PCB congeners. Additionally, in the spring of 2007, PCB sampling was performed on the Potomac River at Chain Bridge. The samples at Chain Bridge were collected to supplement existing data collected at that location and to analyze what impact upstream sources of PCBs would have on the Potomac River estuaries during high and low flows.

The PCB TMDL that was developed for the Tidal Potomac River will help Virginia achieve and maintain the applicable water quality criteria for PCBs, designed to protect human health from the harmful effects of eating contaminated fish. Fish tissue samples collected throughout Virginia's tidal waters in the Potomac River basin regularly contain PCB concentrations at levels that exceed thresholds established by the Virginia DEQ and the Virginia Department of Health (VDH).

Completed TMDL Reports

Since the completion of the 2006 Integrated Report, six TMDL reports covering 34 impaired segments, have been completed by NRO and approved by the U.S. EPA. A Bacteria TMDL for the Pamunkey River Basin was approved by EPA on August 2, 2006. Streams in the Northern Region that are accounted for in this report include Taylors Creek (Louisa County), Northeast Creek (Spotsylvania County) and two portions of the South Anna River (Orange County and Louisa County).

Benthic TMDLs were completed for Bull Run (Fairfax County and Prince William County), Popes Head Creek (Fairfax County and the City of Fairfax), and South Run (Fauquier County and Prince William County) and submitted for approval in May 2006. The Bull Run and Popes Head Creek reports were approved by EPA on September 26, 2006, and the South Run TMDL was approved by EPA on August 2, 2006.

Bacteria TMDLs for nine stream segments in the Occoquan River watershed were approved by EPA on November 15, 2006. Streams in this TMDL report include Popes Head Creek (Fairfax County and the City of Fairfax), three segments of Broad Run (Prince William County), Little Bull Run (Prince William County), Kettle Run (Prince William County), South Run (Fauquier County and Prince William County), Bull Run (Fairfax County and Prince William County), and the Occoquan River (Prince William County).

The Potomac River PCB TMDL was completed in October 2007 and approved by EPA on October 31, 2007. The Potomac PCB TMDL included 18 Virginia embayments located in the Northern Region:

Accotink Creek (Fairfax County), Aquia Creek (Stafford County), Belmont Bay (Fairfax County and Prince William County), Chopawamsic Creek (Prince William County and Stafford County), Dogue Creek (Fairfax County), Fourmile Run (Arlington County and City of Alexandria), Gunston Cove (Fairfax County), Hooff Run (Fairfax County and City of Alexandria), Hunting Run (Fairfax County and City of Alexandria), Little Hunting Creek (Fairfax County), Neabsco Creek (Prince William County), Occoquan River (Fairfax County and Prince William County), Pohick Creek (Fairfax County), Potomac Creek (King George County and Stafford County), Powells Creek (Prince William County), Quantico Creek (Prince William County), Potomac River, Fairview Beach (King George County) and Upper Machodoc Creek (King George County).

In 2007, NRO also completed two TMDL reports which encompassed 16 stream segments in the Rappahannock River Basin. These reports were submitted to EPA on May 2, 2007, and are currently awaiting approval. The Upper Rappahannock Report included the following streams: Hughes River (Culpeper County, Madison County, and Rappahannock County), two segments of the Hazel River (Culpeper County and Rappahannock County), Rush River (Rappahannock County), three segments of the Rappahannock River (Culpeper County, Fauquier County, and Rappahannock County) Craig Run (Fauquier County), Marsh Run (Fauquier County), and Browns Run (Fauquier County). The Rapidan TMDL Report included portions of Blue Run (Albemarle County and Orange County), Marsh Run (Greene County and Orange County), unnamed tributary to the Rapidan River (Orange County), two segments of the Rapidan River (Culpeper County, Madison County, Orange County, and Spotsylvania County), and Cedar Run (Culpeper County).

TMDL Implementation Plan Development

In addition to developing TMDLs necessary to continue with the increasing pace of the Consent Decree Schedule, NRO assisted the primary agency, Department of Conservation and Recreation (DCR), with the development of several bacteria TMDL implementation plans. Since the completion of the Fourmile Run Implementation Plan on June 17, 2004, two additional Implementation Plans have been developed in the Northern Region of Virginia. The Catoctin Creek (Loudoun County) Implementation Plan was approved by the State Water Control Board on June 28, 2005, and the Carter Run, Great Run, Deep Run, and Thumb Run (Fauquier County and Stafford County) Implementation Plan was approved May 2006. The implementation process involved intense coordination between state and federal agencies, local governments, and citizen groups. In the Carter Run, Great Run, Deep Run, and Thumb Run implementation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

Lake Anna Monitoring

Regular Lake Monitoring

In 2002, DEQ and the Lake Anna Civic Association (LACA) worked to develop a monitoring plan for the lake; implemented using the combined resources of NRO and citizen volunteers. This combined monitoring effort began with the first coordinated lake sampling event in 2002. The monitoring plan, effective through 2006, incorporated a three-year sampling rotation where DEQ monitored approximately one-third of the sites on the main lake each year. LACA volunteers monitored those lake stations that DEQ did not sample. The collaborative monitoring effort allowed more extensive lake water quality monitoring than could be achieved individually by either DEQ or LACA. DEQ monitoring was conducted in accordance with Agency lake monitoring guidance, while LACA citizen monitoring was conducted in accordance with a DEQ-approved quality assurance plan.

Investigation of Elevated PCB Levels in Fish Tissue

As a result of the elevated levels of PCBs in fish tissue and the potential for metals contamination from the historical mining activities along Contrary Creek, a federal appropriation was granted through §206 of the Water Resources Development Act of 1996 to undertake a Preliminary Restoration Plan, or Feasibility Study, for Lake Anna. Sampling for Phase I of the study was performed in the late summer and fall of 2004 and included sediment and water column sampling throughout the lake and in free-flowing tributaries. The water column assessment was performed using SPMDs. Phase II sampling was performed in the summer of 2005 and included concentrated sediment sampling utilizing high-resolution gas chromatography and mass

spectrometry to achieve low detection limits for PCB congeners. Phase III sampling was first performed in the summer of 2006 with low-level PCB water column analysis. Samples were taken after a large rain event. Phase III sampling continued in the summer of 2007 with a second round of water column grab samples and the University of Mary Washington taking core sediment samples. These cores samples will be dated and analyzed for low-level PCBs. The investigation is on-going and being implemented cooperatively through the U.S. Army Corps of Engineers, DEQ, LACA, and other federal and local partners.

Virginia Water Facilities Revolving Loan Fund Projects

Since 1987, the Virginia Water Facilities Revolving Loan Fund has been providing low interest loan funding for water quality improvement projects throughout the Commonwealth. Funds are currently provided to local governments, public service authorities, agricultural producers, partnerships, and corporations for a variety of project types. Loan repayments are circulated back into the Fund to create a dedicated source of revenue available for future clean water projects. Examples of some of these projects are described below.

Arlington Water Pollution Control Facility

The Fund has loaned \$167 million to a six-year, \$500 million project designed to upgrade the facility, which will result in the following water quality improvements: expanding the existing 30 million-gallon per day (MGD) to 40 MGD capacity, provide a cost-effective way to treat flows to the facility during storm events (which will address bypasses to Fourmile Run, a tributary to the Potomac River and the Chesapeake Bay), and improve nutrient removal. Additional monies have been loaned to the Alexandria Service Authority and the City of Falls Church for their portions of the project, as the Arlington facility serves portions of the Cities of Alexandria and Falls Church, as well.

Prince William County Service Authority- H.L. Mooney Water Reclamation Facility

Improvements to the facility are needed to operate at 24 MGD to meet the growing number of households and the increasing population in eastern Prince William County. Additionally, nutrient removal upgrades are required at the facility, which discharges into Neabsco Creek, a tributary to the Potomac River and the Chesapeake Bay. The project is expected to be completed by the end of 2010 with an overall cost of \$150 million. Through 2006, the Fund has loaned \$45 million and more is expected to be loaned for completion of the project.

Town of Washington Wastewater Treatment Plant

Presently, the Town of Washington wastewater service area is served through on-site septic tank and drainfield systems, many of which have been documented by VDH as failing. These illicit discharges will be curtailed through the construction of a collection system and treatment plant, estimated to cost \$4 million and financed through a zero-percent Fund loan.